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PRELIMINARY BELT LIFE DATA FOR ABRASIVE PLANING OF PONDEROSA PINE

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ABSTRACT.--Initial observations indicate belt life may be longer and belt loading less at 0.080-inch than at 0.040-inch depth of cut with other machining variables held constant.

OXFORD: 823.1:829.13:174.7 *Pinus ponderosa*.
KEY WORDS: machining, sanding, surfacing, tool life.

Abrasive planing is widely used to avoid knife planing defects when surfacing wood. More than 1/4 inch of stock can be removed by this method, but generally depth of cut averages less than 1/16 inch for hardwoods at 30 to 40 feet per minute and much less than 1/32 inch for softwoods at 90 feet per minute. Proponents of abrasive planing claim economic advantages without sufficient unit cost data. Belt life data for specific combinations of feed rate and depth of cut need to be developed for specific belt speeds before the real cost of removing stock by abrasive planing can be determined.

We do not yet know where studies of depth of cut and feed rates for abrasive planing belt life should begin. So, a short study was undertaken to help establish the initial combinations. Preliminary data indicate that unique factors influence tool life relations for abrasive planer belts and that comprehensive belt life studies will be required to accurately estimate the unit cost for abrasive planing at specified feed rates and depths of cut within the ranges of current machinery.

METHODS

A sample of air-dry (12 percent average moisture content) nominal 2- by 4-inch ponderosa pine lumber was skip-dressed and then surfaced on both 4-inch faces to a uniform thickness so a uniform depth of cut could be maintained in the study. A resinous softwood was selected so that the belt life tests would go faster.

Three depths of cut (0.040, 0.080, and 0.120 inch) were applied to the lumber at a constant feed rate of 90 feet per minute and a nominal belt speed of 5,800 feet per minute. A new belt was used for each depth of cut, and the 4-inch-wide material was fed end-to-end until the belt failed.

RESULTS AND DISCUSSION

The 0.080-inch depth of cut resulted in the longest belt life:

Depth of cut (inches)	*Belt life* (feet)	*Total stock removal* (cubic feet)
0.040	18,689	20.8
.080	21,428	47.2
.120	7,187	24.0

Although the results are limited, the shorter belt life at the 0.040-inch depth of cut than at 0.080-inch depth of cut was suprising. Generally, belt life decreases as depth of cut or stock removal rate increases.

Two explanations are possible. First, the sample for the 0.040-inch depth of cut was at or near the lower tail of a belt life population and the sample for the 0.080-inch depth of cut was at or near the upper tail of a belt life population; and the two populations overlapped to some extent (fig. 1). Second, the belt from abrasive planing at 0.040-inch depth of cut was visibly more loaded with sanding particles than the other two belts (fig. 2). This may indicate that excessive belt loading reduces belt life for 0.040-inch depth of cut. Further, sample end points of belt life where the test results overlap could be misleading alone. Inspection of the belts is also required.

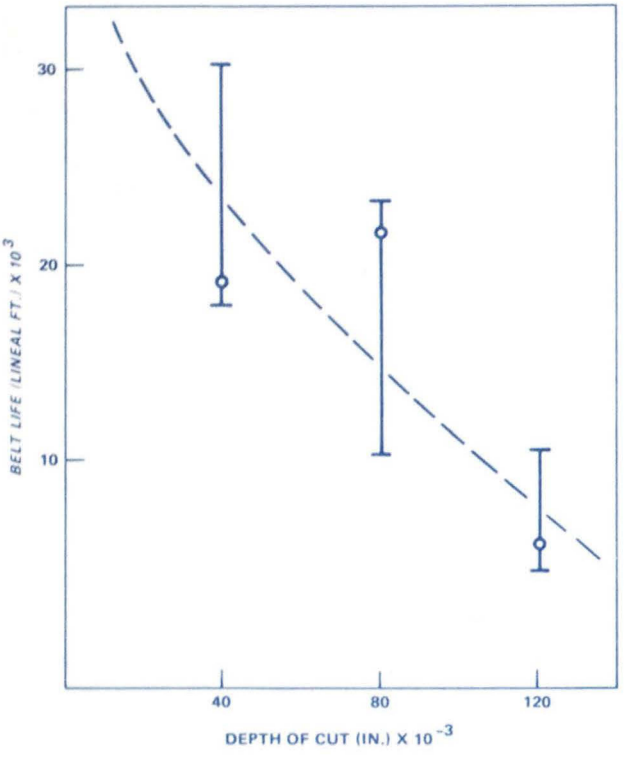

Figure 1.--*Possible relation of belt life to depth of cut if a single sample at 0.040-inch depth of cut were near the bottom of the population range and a single sample at 0.080-inch depth of cut were near the top of the population range for respective machining situations.*

The excessive loading of the belt at 0.040-inch depth of cut suggests a relation between sanding particle size and open space among the belt backing, grit, and workpiece when machining. Small particles from shallow depths of cut (approximately 0.015 inch or less) fit or are easily carried through the spaces formed by the belt backing, grit, and workpiece. At moderate depths of cut (such as 0.040 inch), the particles appear to be packed into the open spaces. At greater depths of cut (such as 0.080- and 0.120-inch) the sanding particles (chips) may be large ehough to be forced ahead of the cutting tool (grit) and perhaps too large for the spaces. Thus, the large particles may create a wiping or cleaning action. Also, at the 0.120-inch depth of cut stresses and tool wear are much greater, thus reducing belt life.

High feed rates at slower belt speeds may prolong belt life. A long, thin particle could be "bunched up" to perhaps wipe or clean the belt similar to what happens with larger particles produced at depths of cut of 0.080-inch or greater. Another alternative would be to increase belt speed enough to approach a "zero" depth-of-cut condition. Actually, a wide selection of untried abrasive planing conditions may be as efficient or more efficient than present prescriptions.

Knots, because they cause instant power increases and, hence, stress increases, may have shortened belt life. The rapid stress increases would probably reduce belt life more at deeper cuts, such as at 0.080- and 0.120-inch, where the unit belt stress is higher initially. Thus, belt loading was apparently the major cause of short belt life at the 0.040-inch depth of cut.

Observations of commercial practice indicate the depth of cut for abrasive planing softwood lumber averages 0.010-inch with grit Nos. 24 and 36 at a feed rate of 90 feet per minute and belt speed at 5,800 feet per minute. Our preliminary tests indicate that abrasive planing at moderate depths of cut such as 0.040 inch may cause excessive belt loading and reduce belt life (fig. 3). The tests further indicate that heavy stock removal rates at depths of cut 0.080 or greater may reduce belt loading and prolong belt life. Thus, stock could probably be economically removed at other relative machining conditions. However, extensive tests will be required to determine the most efficient operating conditions for abrasive planing hardwoods and softwoods.

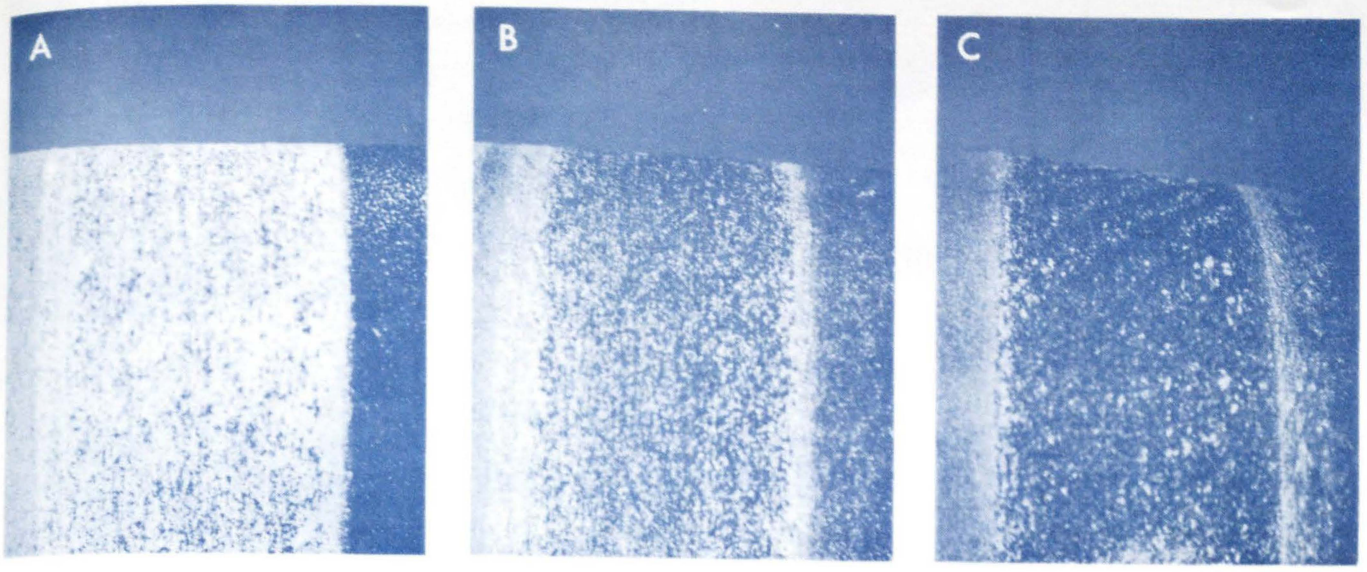

Figure 2.--*No. 36 grit belt condition after machining ponderosa pine at 90 feet per minute feed rate and 5,800 feet per minute belt speed: (A) 0.040-inch depth of cut; (B) 0.080-inch depth of cut; (C) 0.120-inch depth of cut.*

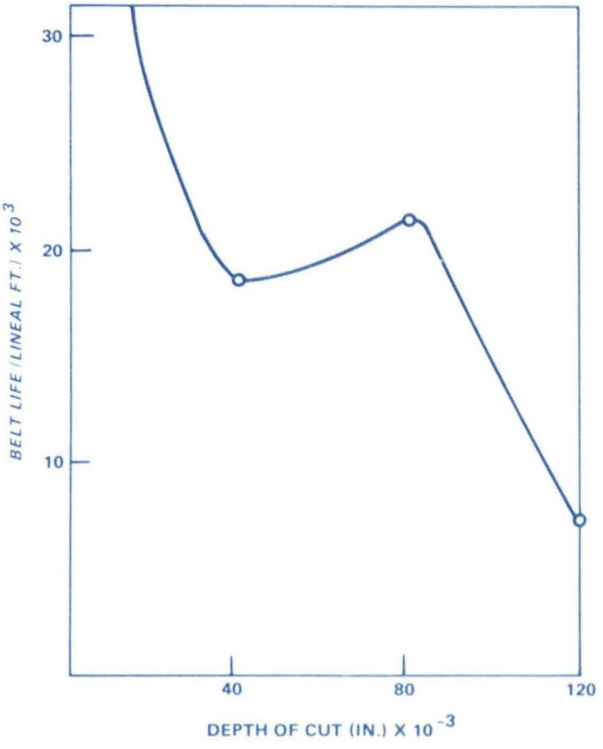

Figure 3.--*Possible relation of belt life to depth of cut if a relation between sanding dust particle size and belt loading exists.*

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